



Total Cost Assessment

A Useful Tool for Integrating EH&S and Risk into
Decisions for Sustainable Development

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The Dow Chemical Company

What is TCA?

TOTAL COST ASSESSMENT(TCA) is a modeling tool for Better Understanding of Costs and Benefits Associated with Environmental Health and Safety (EH&S) Decision Making, Including Direct, Indirect, Contingent Risk, Liabilities and Externalities developed by the AIChE Center for Waste Reduction Technologies (CWRT).

Companies Involved in AIChE Center for Waste Reduction Technology (CWRT) Collaboration (Names at time of Collaboration)

Bristol-Myers Squibb

Merck

The Dow Chemical Company

Monsanto

Eastman Chemical

Owens Corning

Eastman Kodak

Rohm & Haas

Georgia Pacific

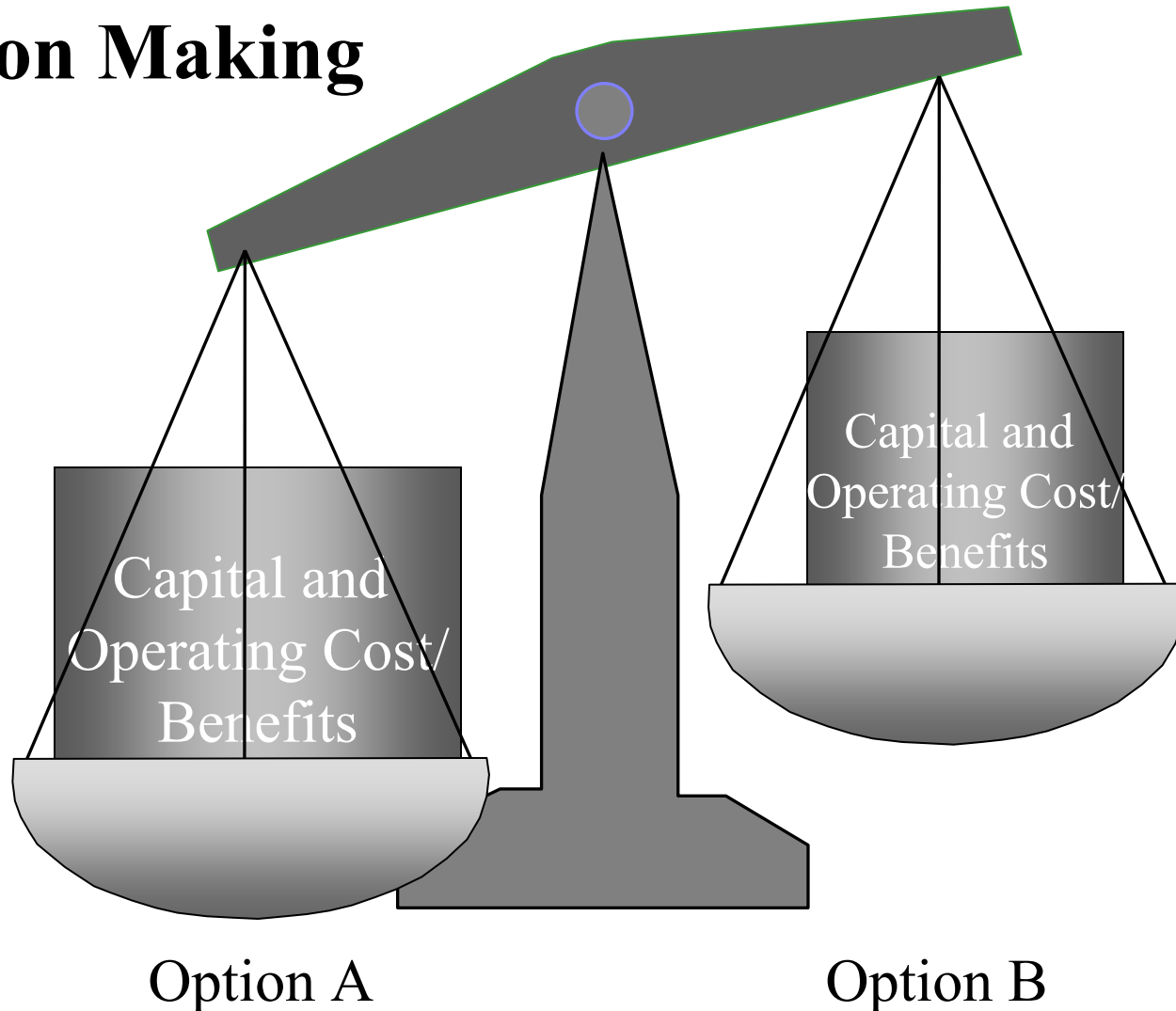
SmithKline Beecham

Arthur D. Little - Research Contractor and Program Collaborator
Sylvatica (Greg Norris) - TCAce

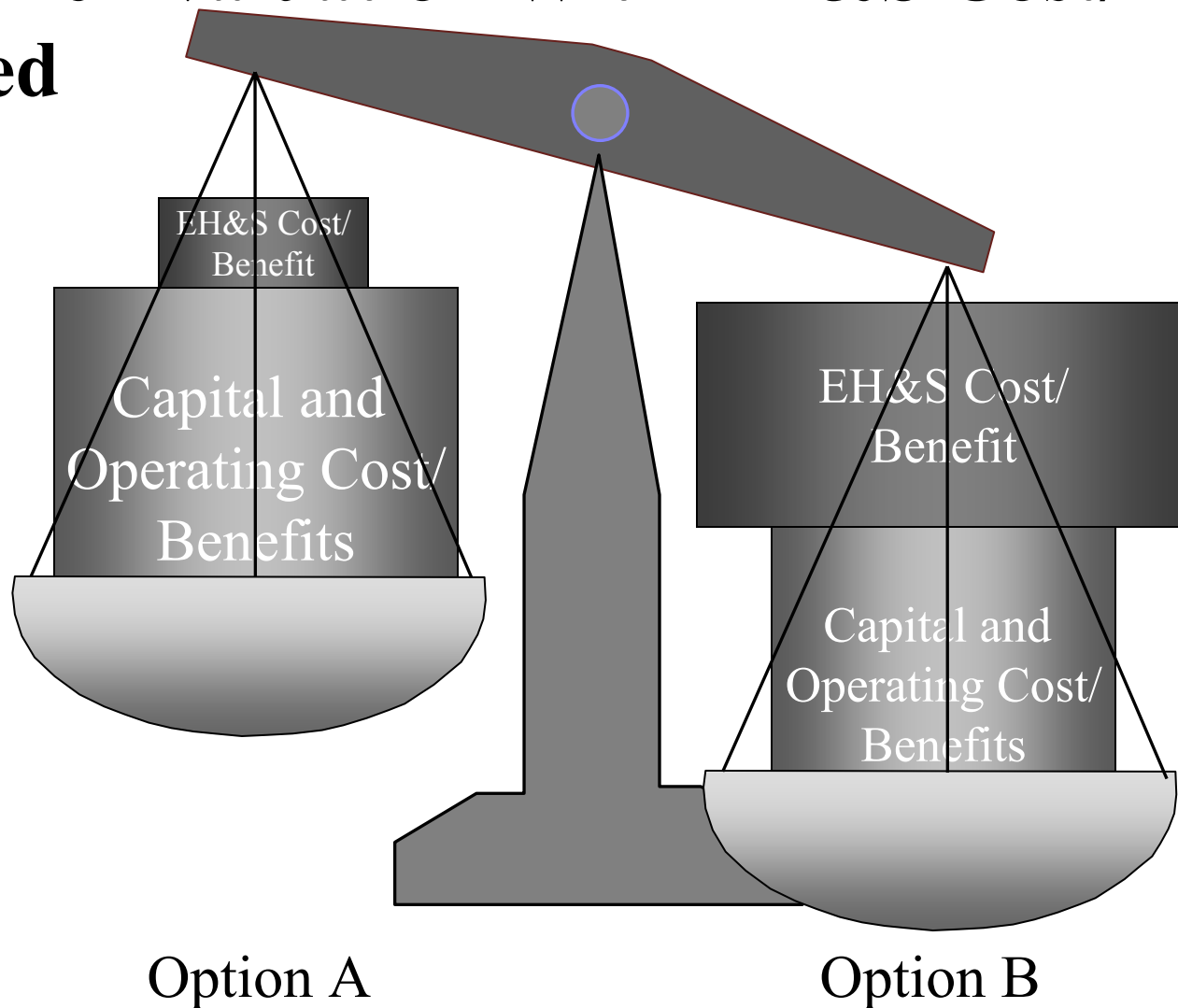
Conventional Decision Making Process

The FULL monetary cost or benefit of Corporate Social Responsibility and Environmental Stewardship (EH&S issues) have NOT been presented in an economic format (\$'s) to business leadership for decision making

Conventional Economic Evaluation for Decision Making



Economic Evaluation With EH&S Cost/Benefit Included



Objectives of TCA Tool

- **Understand the significance of EH&S related decisions in the past, present and especially the future.**
- **Utilize multidisciplinary expertise to achieve a systematic, documented portrayal of alternatives.**
- **Integrate internal costs ‘and’ externalities into a single assessment process**
- **Translate EH&S impacts to monetary benefits and costs for improved decision making**

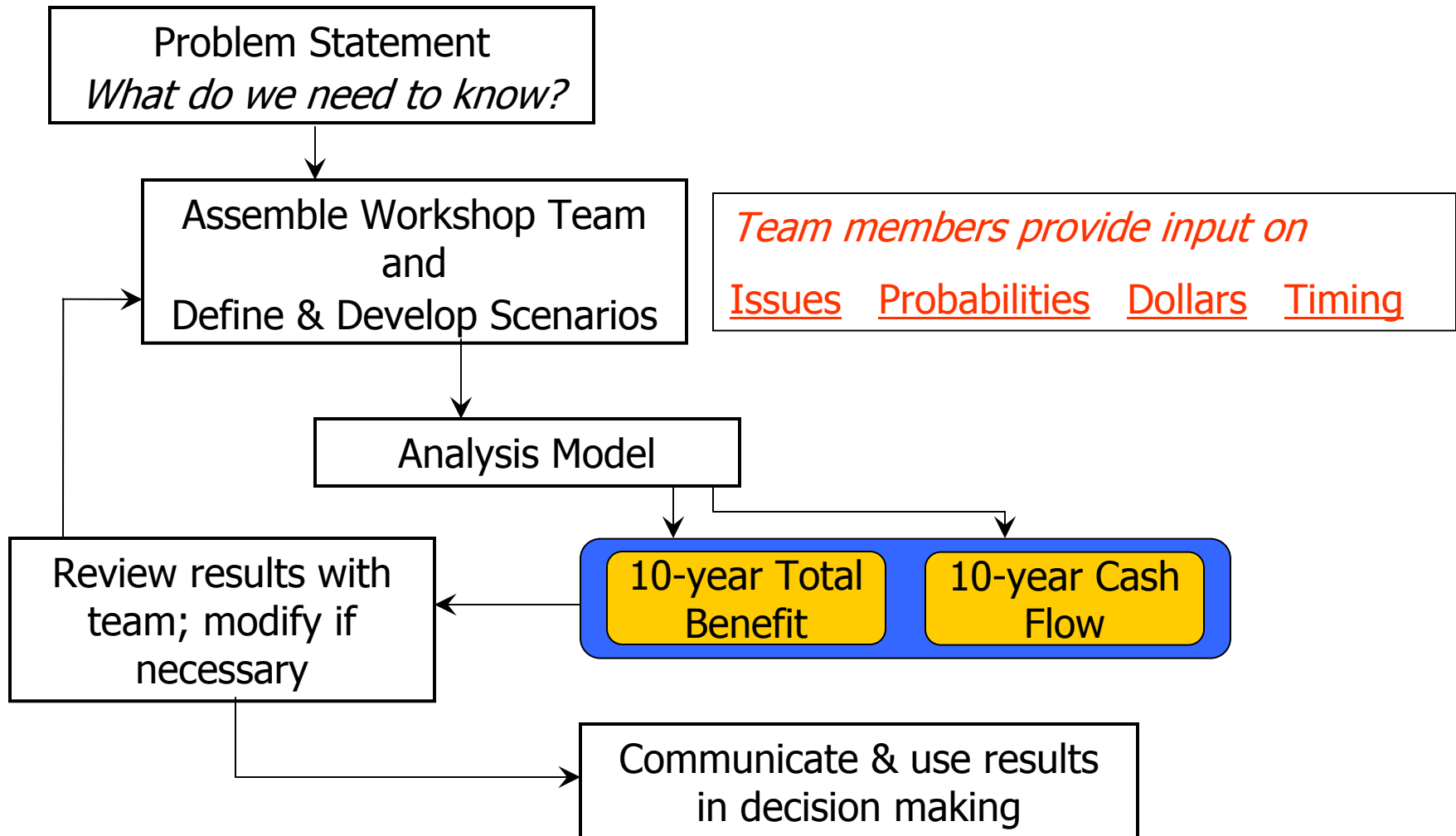
TCA Types of Benefits/Costs

I & II	Conventional economics	Often referred to as the “Hard” economics which have historically been applied
III	Future & contingent liabilities <ul style="list-style-type: none">- fines & penalties, legal fees- business interruptions- cost of environmental cleanup- cost to discharge wastewater	Often referred to as the “Soft” economics which have NOT been historically translated to economic units
IV	Intangible internal costs <ul style="list-style-type: none">- corporate image- public perception	
V	Costs the company does not pay	costs borne by society and include deterioration of the environment by pollutant dispersions

TBCA Types of Benefits/Costs (Dow Version)

I & II Conventional economics	→ Often referred to as the “Hard” economics which have historically been applied
III Future & contingent liabilities <ul style="list-style-type: none">- fines & penalties, legal fees- business interruptions- cost of environmental cleanup- cost to discharge wastewater	→ Often referred to as the “Soft” economics which have NOT been historically translated to economic units
IV Intangible internal costs <ul style="list-style-type: none">- corporate image- public perception	

TBCA Process Overview



Alternative	<u>Time Period</u>	<u>Estimated Cost</u>	<u>Probability</u>	
→ Scenario 1	→ Year 1	Cost 1	Probability 1	→ 10-year assessment
	Year 2	Cost 2	Probability 2	
→ Scenario 2	Year 3	Cost 3	Probability 3	
	.	.	.	
→ Scenario 3	.	.	.	
	.	.	.	
.	Year 10	Cost 10	Probability 10	
.				
.				
→ Scenario X				

Mechanics - “Workshop” Approach Used for Dow TBCA Process

- Workshops configured for 1-2 days - Key business, legal, public relations, EH&S, project people, etc. needed for TBCA data/analysis
- Highly disciplined process with total focus on TBCA - due to limited time
- Scenarios used to clearly document key issues, data, judgements and decisions
- Usually requires significant pre-work



‘Functional’ Applications in Dow

Dow Chemical EH&S 2005 Goals

- Emissions - Priority and Chemical
- Personal Injury - Illness
- Loss of Primary Containment and Process Safety
- Waste - TTU's and Kilns
- Waste - Landfills
- Wastewater
- Energy

TOTAL COST ASSESSMENT RESULTS EH&S 2005 GOALS				
	Type I/II Costs/Benefits		Type III Costs/Benefits	Type IV Costs/Benefits
	Unit Costs		Unit Costs	Unit Costs
<i>Emissions</i> Target: 90% Reduction of Primary and 50% Reduction of Chemical	Project Specific'	\$/ton	\$/ton	\$/ton
<i>Waste:</i> Target: 50% Reduction of Waste per Pound of Prod.				
<i>TTUs</i>	Project Specific	\$/mt	\$/mt	\$/mt
<i>Kilns</i>	Project Specific	\$/mt	\$/mt	\$/mt
<i>BOD IN WWTP</i>	Project Specific	\$/mt	\$/mt	\$/mt
<i>Landfills</i>	Project Specific	\$/m3	\$/m3	\$/m3
<i>Wastewater:</i> Target: 50% Reduction of Wastewater per Pound Prod.	Project Specific	\$/m3	\$/m3	\$/m3
<i>Energy:</i> Target: 20% Reduction of Energy per Pound of Production	Project Specific	\$/MM Btu	\$/MM Btu	\$/MM Btu
<i>LOPC</i> Target: 90% Reduction in Incidents	Project Specific	\$/Incident	\$/Incident	\$/Incident
<i>Process Safety</i> Target: 90% Reduction in Incidents	Project Specific	\$/Event	\$/Event	\$/Event
<i>Personal Injury and</i> Target: 90% Reduction in Incidents	Project Specific	\$/Incident	\$/Incident	\$/Incident

‘Business’ Applications in Dow

- EDC/Vinyl Expansion Alternatives
- Chlor-Alkali Cell Technology Evaluation
- Polycarbonate Technology Route
- New Sustainable Product
- Fresh Water conservation valuation
- Biosolids reduction alternatives
- Carbon sequestration evaluation

Deliverables of TBCA Workshop

- Deliver results and ideas to support product, project or activity decisions
- Provides a more complete look – challenges the negatives and encourages looking at alternatives
- Translates, in a disciplined methodology, what is believed to be the “right thing to do” into dollars (\$’s)

What TOTAL COST ASSESSMENT Is Not

- TCA as developed by the AIChE CWRT Collaboration was **NEVER** considered to be a replacement for or in competition with:
 - Accounting practices and/or system
 - Economic evaluation principles or methodology
 - Corporate planning
 - Future economic projections / forecasting
- Rather it was intended that TCA complement these processes to **facilitate improved decision making**

TCAce - OpenLC

TCAce - OpenLC is software developed to help with TCA analysis. It is undergoing beta testing now. It will be available from:

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Questions?